# NOTES ON NORTH AMERICAN HYPOCREALES—III. TWO NEW SPECIES WITH STUDIES OF THEIR LIFE HISTORIES

Fred J. Seaver

(With Plate 30, Containing 13 Figures)

So little is known of the life histories of the polymorphic species of the present order that any information which can be gained as to the complementary phases where the ascigerous stage is known is of much interest to mycologists. Not only is this true because of the fact that it gives us the knowledge of the life history of the individual species studied, but it furnishes at least a clue as to the direction in which to look for the complementary stages in other species where only the perfect or imperfect stages are known.

In my own studies of the Hypocreales, I have been much interested in the group of so-called imperfect fungi known as the Verticillieae and their perfect stages, several of which have been noted among nectriaceous plants. The Verticillieae are characterized by the verticillately branching conidiophores, the plants resembling in this respect *Penicillium*. The conidia are hyaline and borne either singly or in chains. The conidiophores often spring from a more or less well-developed stromatic base, giving the whole a floccose appearance of a whitish or pinkish color.

Among the Nectriaceae, the first species studied which was found to be associated with a *Verticillium* was *Creonectria ochroleuca* (Schw.) Seaver. This species has proved to be very common and a number of synonyms have been worked out. The examination of the types or cotypes of several of these synonyms has shown them to be associated with a *Verticillium*. Spegazzini seems to have been the first to call attention to the association of this *Nectria* with a *Verticillium* in his description of *Nectria vulgaris* Speg., which species is a synonym of the above. The

conidial stage of this species was also described as *Verticillium tuberculoides* Speg.

*Creonectria seminicola* Seaver, which, as stated in a previous paper, is closely related to the above, has also a *Verticillium* as its conidial stage.

*Nectria Bainii* Massee, which occurs an cacao pods in the West Indies, is also associated with a *Verticillium*. Our conclusion is here based on the examination of material collected in the West Indies, the identification of which has been confirmed at Kew and the specimens pronounced to be typical *Nectria Bainii* Massee. This species differs from the two preceding only in the slightly larger ascospores.

Recent studies of two undescribed species of nectriaceous plants, both of which have been found to be associated with Verticillieae, have furnished the data for the present paper.

The first of these, collected in Mexico during the winter of 1910 by Dr. W. A. Murrill, was reported to be a parasite on the stems of an undetermined palm. The original collection showed numerous pinkish stromata covering the stems of the host. A study of the microscopic characters showed the fungus to be one of the Verticillieae, and it was at once suspected that the fungus might be the conidial phase of a *Nectria* or one of the related genera. This suspicion was confirmed by the finding of other specimens of the host with both the conidia and perithecia. The conidia and perithecia were so intimately associated that it seemed likely that they represented two stages in the life history of the same fungus.

The ascospores are of an olivaceous or smoky-brown color, which character would place the fungus in the genus *Macbridella*. This genus was founded by the writer* to include two species of colored-spored, stromatic Nectrieae, both of which were collected in Central America. The occurrence of a new and third species of this genus in Mexico is of interest from the standpoint of distribution. It is also of interest to note that a fourth species which would properly belong to this genus has been reported from South America. These facts would indicate that the genus is composed largely of tropical species. The three North American

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species reported, while clearly belonging to the same genus, are specifically very different. The fact that this species occurs on the living stems of the host and is apparently connected with a group of fungi which is of some economic importance prompted an investigation of its life history.

## CULTURE EXPERIMENTS

Drop cultures were made of the conidia and ascospores and both were found to be in a germinating condition. The ascospores produce usually two germ-tubes, which in twenty-four hours attain considerable length.

The host of the parasite was undetermined, and a small piece of the leaf was the only clue which we had as to its identity. In order to select a suitable host on which to cultivate the fungus, a visit was made to the palm house of the conservatories of the New York Botanical Garden with the hope or finding a plant similar to the fragment brought from Mexico. The leaves of plants of the genus *Chamaedorea* resemble the Mexican specimen, and a species of this genus was selected (*Chamaedorea Sartorii*) which was known to occur in Mexico. Unfortunately, the plants of this genus were not sufficiently abundant in the conservatories to permit of a living plant being used for inoculation, so a leaf was removed and the petiole used in our preliminary experiments.

The petiole was cut into pieces 2–3 inches in length. One of these was split and the inoculations made the full length of the split surface with the conidia from the original collection. The other speicmens were inoculated on the cut ends only. All were placed in test tubes with the lower ends immersed in distilled water. In about ten days, the split stems showed an abundant infection, the conidia being more or less effused and nearly covering the whole of the cut surface. The stromata later appeared on the opposite side of the stem, being at first scattered but later becoming more or less confluent. The color, as in the original specimen, was at first white, becoming pink with age. The plants were identical both in gross appearance and microscopic characters with the specimens from which the inoculations were made.

The specimens which were inoculated on the cut ends only took

the infection more slowly. The stems gradually became blackened, as was also the case in the preceding experiment, the stromata appearing as small pustules near the end of the stem, and gradually spreading down its side.

Other inoculations were made in a similar way on the petioles of the same and other species of *Chamaedorea,* and an abundant infection of the conidia followed in nearly every case. All of the culture material was allowed to remain moist, with the hope of producing perithecia. The latter part of April, about two months from the time of the planting of the conidia, perithecia were observed in two of the cultures, being produced in small clusters or occasionally more or less scattered. Perithecia were later seen in one of the cultures belonging to the second set of inoculations.

Both the perithecia and spores in the culture-grown specimens differed slightly from the original material, but these differences seemed to be due to the fact that the specimens were not properly matured. The perithecia were dull-red in color, while in the original material they were covered with olivaceous granules. The spores, also, were almost destitute of color. However, all of the morphological characters with the exception of the two mentioned above indicate that the species grown in culture is identical with the one from which the inoculations were made. The species may be described as follows:

**Macbridella olivacea** sp. nov.

Stromata erumpent, with a rather compact center, overtopped by numerous branching conidiophores, giving the whole a loose floccose appearance, at first white, becoming pink, about 1 $\mu$ in diameter, scattered or confluent; conidiophores verticillate-branched; conidia borne in chains, ellipsoid, 4–5 $\times$ 5–6 $\mu$; perithecia occurring in cespitose clusters on or surrounding the stroma, dull-reddish, covered with olivaceous granules, giving the clusters a dark, greenish-black color; asci cylindric, 8-spored; spores 1-seriate, with the ends overlapping, fusoid or subelliptic, at first hyaline and surrounded by a transparent envelope, 1-septate, becoming olivaceous or smoky-brown and slightly constricted at the septum, externally marked with coarse striations, giving the surface a roughened appearance, with an oil-drop in each cell, 12–15 $\times$ 8 $\mu$.

Type collected at Motzorongo, Mexico, on the stems of an undetermined wild palm, January 15, 1910, *W. A. Murrill 911.*

DISTRIBUTION: Known only from the type locality.

The second species described in this paper was first observed in the propagating houses of the New York Botanical Garden in

FIG. 1. Colonies of *Nectria zonata* Seaver spreading over green algae on flower pot.

1906, where it was found growing on the surface of soil covered with green algae. It was also later observed on the outside of pots containing living plants, always, so far as observed, spreading over green algae, *Pleurococcus,* etc. During the last two

years it has been under observation on such habitats, as it appeared continuously during this period on various pots in different parts of the propagating houses (*fig. 1*).

The most characteristic feature of the species is the appearance of a scant mycelial growth, which gradually radiates out from a common center and apparently originates from a single infection. As the mycelium proceeds outward, forming concentric rings or zones, it disappears in the center, leaving a bare space surrounded by the gradually enlarging rings of mycelium. The perithecia later appear scattered over the mycelial growth or in the central portion where the mycelium has disappeared. The mycelium is very scant and never, so far as observed, gives rise to a stroma, but at intervals under favorable conditions produces very delicate white tufts of conidiophores bearing conidia. While apparently belonging to the Verticillieae, both conidiophores and conidia are very different from those of the preceding species (*pl. 30*). The characters mentioned above would place this species in the genus *Nectria*. A diagnosis of the species follows.

**Nectria zonata** sp. nov.

Perithecia preceded by a scant mycelial growth which radiates from a common center, giving rise to concentric rings or zones, finally disappearing in the center, leaving a bare space surrounded by the gradually expanding rings of mycelium, with the conidiophores and conidia appearing as delicate white tufts; conidiophores verticillate-branched, with the conidia-bearing branches enlarged below, gradually tapering toward the apex; conidia borne in chains, fusiform, 10–12 × 5 μ, granular within and often appearing very minutely roughened; perithecia scattered, rarely two together, numerous, pale-orange or flesh-red, becoming slightly darker in dried specimens, under conditions of moisture covered, especially near the base, with a mycelial growth giving the plants a whitish appearance, or entirely naked; ostiolum slightly prominent, entire or rarely collapsing in dried specimens; asci clavate, 8-spored; spores partially 2-seriate or irregularly crowded, unequal-sided, broad-fusoid, 1-septate, slightly constricted at the septum, with the lower of the two cells narrower, filled with numerous oil-drops, hyaline, 17–18 × 8–9 μ.

Type collected in the propagating houses of the New York Botanical Garden on the outside of a pot containing living plants, May 20, 1910, *F. J. Seaver*.

DISTRIBUTION: Known only from the type locality.

EXPLANATION OF PLATE XXX

FIGS. 1–5. *Nectria zonata* Seaver

1. Perithecia.
2. Asci and spores.
3–5. Conidiophores and conidia.

FIGS. 6–13. *Macbridella olivacea* Seaver

6. Perithecia and stroma.
7. Portion of an ascus with spores.
8–10. Germinating ascospores after twenty hours in drop culture.
11. Young stromata.
12. Conidiophore and conidia (partially diagrammatic).
13. Conidiophore and conidia.

Figs. 2–5, 7–10, and 13 were drawn with the aid of the camera lucida.